

**DIRECTORATE FOR FINANCIAL AND ENTERPRISE AFFAIRS  
COMPETITION COMMITTEE**

DAF/COMP/WD(2014)132  
Unclassified

**THE COMPLEMENTS PROBLEM WITHIN STANDARD SETTING: ASSESSING THE EVIDENCE  
ON ROYALTY STACKING**

-- Article by Anne Layne-Farrar, Damien Geradin and A. Jorge Padilla --

**17-18 December 2014**

*This article by Anne Layne-Farrar, Damien Geradin and A. Jorge Padilla was submitted as background material for the hearing on Competition, Intellectual Property and Standard Setting, which will take place at the 122nd meeting of the OECD Competition Committee on 17-18 December 2014. It is entitled "The Complements Problem Within Standard Setting: Assessing The Evidence on Royalty Stacking," Boston University Journal of Science and Technology Law, 2008.*

*The opinions expressed and arguments employed herein do not necessarily reflect the official views of the Organisation or of the governments of its member countries.*

*More documents related to this discussion can be found at <http://www.oecd.org/daf/competition/competition-intellectual-property-standard-setting.htm>.*

*This document is available as a PDF only*

**JT03367264**

Complete document available on OLIS in its original format

*This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.*



---

# ARTICLE

## THE COMPLEMENTS PROBLEM WITHIN STANDARD SETTING: ASSESSING THE EVIDENCE ON ROYALTY STACKING

DAMIEN GERADIN, ANNE LAYNE-FARRAR, AND A. JORGE PADILLA<sup>1</sup>

### TABLE OF CONTENTS

I. INTRODUCTION .....	145
II. ROYALTY STACKING: AN OVERVIEW OF THE THEORY AND EVIDENCE .....	150
A. <i>The Tragedy of the Anti-Commons</i> .....	151
B. <i>Patent Thickets</i> .....	153
C. <i>Royalty Stacking</i> .....	154
D. <i>Empirical Literature</i> .....	155
1. Evidence from the Semiconductor Industry .....	155
2. Evidence from the Software Industry .....	156
3. Evidence from the Biomedical Industry .....	157
4. Evidence from Mobile Telephony .....	159
III. MARKET MECHANISMS FOR OVERCOMING ROYALTY STACKING .....	163
A. <i>IPRs as a Means for Increasing Public Knowledge</i> .....	163
B. <i>Incentives to License</i> .....	165
C. <i>The Benefits of IPR Pooling</i> .....	167
IV. POLICY PROPOSALS .....	168
A. <i>Patent Reform</i> .....	168
B. <i>Ex Ante Licensing</i> .....	170
C. <i>Joint Negotiations Among Licensees</i> .....	173

---

<sup>1</sup> Damien Geradin, Ph.D. Cambridge (1995) is a Professor of Competition Law at Tilburg Law and Economics Center (TILEC) and a Partner at Howrey LLP; Anne Layne-Farrar, Ph.D. University of Chicago (1999) and Jorge Padilla, D.Phil. Oxford (1992) are economists at LECG Consulting. An earlier version of this essay was prepared for the workshop on *Standardization, IP Licensing and Antitrust* held by the Tilburg Law and Economics Center (TILEC) in Brussels on January 17-18, 2007. We wish to thank Daniel Garcia-Swartz, Doug Lichtman, Robert Merges, Michael Noel, Alison Oldale, Alejandro Requejo, David Salant, Mark Schankerman, and Elena Zoido for their comments and suggestions. We also thank Matthew Bennett, Marina Danilevsky, and Sannu Shrethsa for invaluable research support. Financial support from Qualcomm is gratefully acknowledged. The ideas and opinions in this paper are exclusively our own. Comments should be sent to GeradinD@howrey.com, alayne-farrar@lecg.com and jpadilla@lecg.com.

2008]	<i>THE COMPLEMENTS PROBLEM</i>	145
	<i>D. Limiting Injunctive Relief</i> .....	174
	V. POLICY CONCLUSIONS .....	175

Royalty stacking, the most recent incarnation of the complements problem identified in the early 1800s by French engineer Augustine Cournot, has received considerable attention. The potential for royalty stacking within standard setting efforts arises from the fact that downstream manufacturing companies can face multiple upstream gatekeepers, each of whom must grant a license to their “essential” patents before the downstream firms can legally commercialize the standard. Some authors have claimed that in high-tech industries—which are frequently characterized by cumulative innovation, dispersed ownership of patents, and cooperative standard setting efforts—the cost of obtaining all necessary licenses is too high, such that innovation has been thwarted and consumers have been harmed. In this paper, we assess the case for royalty stacking within standards and find the evidentiary support weak at best. We note that the relevant question is not whether royalty stacking is *possible*, as the theoretical arguments behind it have withstood the test of time, but whether it is common enough and costly enough in actuality to warrant policy changes. The available evidence suggests not, implying that any policy changes aimed at solving royalty stacking are likely to cause more (unintended) harm than they cure.

## I. INTRODUCTION

As technical complexity in the products and services that drive the economy has grown, so has the need for standardization. Formal standards, where a diverse set of firms cooperate to define and/or develop the technical specifications of a product or service, can ensure that products and services with multiple inter-working components operate as planned and interoperate as needed with other products and services. At the same time cooperative standardization has increased in importance. Perhaps not coincidentally, intellectual property rights (IPR) have grown more prominent as well, especially patenting. The result of these converging trends is that the IPR licensing behind the products and services defined by cooperative standards has grown in complexity. And thus so have fears of “royalty stacking”, whereby the number of licenses required to bring a product or service to the marketplace stack up, one atop the other, potentially creating an insurmountable barrier to commercialization.

Despite the new jargon, the economic logic behind royalty stacking has a long history. Royalty stacking is at its heart a reincarnation of the “complements problem” first studied by the French engineer Augustin Cournot in 1838.<sup>2</sup> Cournot showed that consumers are better off when all products that are complementary from a demand viewpoint are produced and marketed by a

---

<sup>2</sup> AUGUSTIN COURNOT, RESEARCHES INTO THE MATHEMATICAL PRINCIPLES OF THE THEORY OF WEALTH (Nathaniel T. Bacon trans., The Macmillan Co. 1987) (1838).

single firm. The trend today in a number of industries, however, is toward disintegration, not conglomeration.<sup>3</sup> Hence the renewed interest in the complements problem, this time centered on IPR licensing.

Information and communication technology (ICT) industries are a particular area of concern for royalty stacking, due largely to the horizontal complementarities involved. Consider a high-tech product, such as a mobile phone, a DVD player, or an MP3 player. Each of these products incorporates multiple innovations. For example, in addition to the handset casing itself—which might be “razor” thin or have a user-friendly touch screen—a mobile phone contains a number of semiconductor chips that provide the core instruction sets for the handset’s operation. The mobile phone, in turn, only works if it is linked into a network comprising base stations to receive and relay the airwave signals from handsets and a primary network to carry the signals on to their ultimate destination (and back again). If each of the complementary components in this product-service chain incorporate patented technologies, and if those patents are owned by different patent holders (as they are likely to be), then royalty stacking could occur. From the perspective of a manufacturing company seeking to implement and commercialize a standard, the patents are strict complements: the company needs to obtain licenses for all “essential” IPR in order to be compliant with the standard and, equally important, to avoid the risk of being sued for patent infringement with the subsequent risk of abrupt termination of business.

The potential for difficulties arises from the fact that downstream companies face multiple gatekeepers, each of whom must grant a license before a product can be legally commercialized. When each of those gatekeepers (patent holders) considers which royalty rate to charge for its IPR (among the other terms and conditions to be negotiated in a license agreement),<sup>4</sup> it may not fully take into account that an increase in its royalty is likely to result in a cumulative royalty rate that may be too high according to both the licensee and the other patent holders. Since each patent holder may ignore the negative externality caused by its own pricing policies, the aggregate royalty fee for licensing all of the required pieces of the standard may add up to a very large amount—perhaps so large that it is no longer economical for the downstream company to implement and commercialize the standard. In such an event, just as suggested by Cournot, licensees would be better off if all licenses were consolidated under the control of a single patent holder acting on behalf of the group as a whole. This is, in fact, one of the key motivations for patent pools,

---

<sup>3</sup> See Richard N. Langlois, *The Vanishing Hand: The Changing Dynamics of Industrial Capitalism*, 12 *INDUS. & CORP. CHANGE*, 351 (2003).

<sup>4</sup> License agreements can contain any number of financial and non-financial terms, including upfront payments, milestone payments, royalties, exclusivity terms, etc. To simplify notation, we use royalty rate in this paper as shorthand for all of these licensing terms.

which consolidate patent rights into a single bundle.<sup>5</sup>

Relying on this logic, some authors have claimed that in high-tech industries—which are frequently characterized by cumulative innovation and dispersed ownership of patents—the cost of obtaining all necessary licenses is too high, such that innovation has been thwarted and consumers have been harmed.<sup>6</sup> Under this view, market-driven mechanisms, such as cross licensing, patent pools, and reputation effects, are considered insufficient to completely solve royalty stacking, especially in industries such as telecommunications and computing where new technologies frequently develop under the auspices of standard setting organizations.<sup>7</sup> Standards add a layer of intricacy to the issue since they involve cooperative efforts by otherwise rival firms.

A number of proposals have been put forth to solve the perceived complements problem within standard setting, all aimed at lowering royalty rates. To this end, one proposal is to modify the IPR rules and procedures in place at standard setting organizations (SSOs) by requiring firms that hold patents they consider might be essential to a potential standard to disclose their licensing terms prior to the adoption of the standard.<sup>8</sup> In this way, SSO participants could consider licensing terms along with technical and quality issues and they could assess the potential aggregate cost of a particular specification prior to any vote. A more formal suggestion along these same lines is for an SSO, again during the development phase of a standard, to hold an auction whereby IP rights holders vying to have their technology adopted in the standard would submit offers to license that technology downstream in

---

<sup>5</sup> See, e.g., Robert Merges, *Institutions for Intellectual Property Transactions: The Case of Patent Pools*, in *INTELLECTUAL PRODUCTS: NOVEL CLAIMS TO PROTECTION AND THEIR BOUNDARIES* (Rochelle Dreyfuss, ed., 2001), <https://www.law.berkeley.edu/institutes/bclt/pubs/merges/pools.pdf>.

<sup>6</sup> See, e.g., Thomas D. Kiley, *Patents on Random Complementary DNA Fragments?*, *SCIENCE*, Aug. 14, 1992, at 915; Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, *SCIENCE*, May 1, 1998, at 698 (based on a more formal analysis by Michael Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 *HARV. L. REV.* 621 (1998)) [hereinafter Heller & Eisenberg]. See also Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard-Setting*, 1 *INNOVATION POLICY AND THE ECONOMY* 119, 120 (2001) [hereinafter Shapiro, *Navigating the Patent Thicket*]; Mark A. Lemley & Carl Shapiro, *Frontiers of Intellectual Property: Patent Holdup and Royalty Stacking*, 85 *TEX. L. REV.* 1991, 1993 (2007) [hereinafter Lemley & Shapiro, *Patent Holdup*].

<sup>7</sup> Shapiro, *Navigating the Patent Thicket*, *supra* note 6.

<sup>8</sup> See e.g., Gil Ohana, Marc Hansen, & Omar Shah, *Disclosure and Negotiation of Licensing Terms Prior to Adoption of Industry Standards: Preventing Another Patent Ambush?*, 24 *EUROPEAN COMPETITION L. REV.* 644, 648 (2003). See also Damien Geradin & Miguel Rato, *Can Standard-Setting lead to Exploitative Abuse? A Dissonant View on Patent Holdup, Royalty Stacking and the Meaning of FRAND* 26, 33 (Nov. 2006) (unpublished working paper), <http://ssrn.com/abstract=946792>.

addition to touting their technological specifications.<sup>9</sup> The technology winners of the auction would comprise the final standard and the auction terms would define the maximum royalty rate allowable ex post. Taking ex ante licensing disclosure even further, another proposal suggests that antitrust authorities should take a lenient approach toward joint negotiations of licensing terms within SSOs before a standard is adopted.<sup>10</sup><sub>[m2]</sub> While joint price setting is usually anathema in antitrust, the idea here is that collective bargaining would exert pressure on licensing prices that the current SSO system of confidential bilateral negotiations does not. Yet other authors have suggested that joining an SSO and committing to its IPR policy forfeits the right of patent holders to seek injunctive relief for patent infringement in the context of standards.<sup>11</sup><sub>[m4]</sub> Without the threat of shutting down a manufacturer through an injunction, patent holders would have a weakened position in licensing negotiations, giving licensees more power to push for lower royalties.

On the other side of the debate, some authors have challenged the royalty stacking concerns, arguing that countervailing factors already exist that limit the complements problem in IPR licensing. For example, some point out that, as a practical matter, enforcing intellectual property rights is difficult and costly and, in consequence, the protection afforded by those rights is more limited in reality than on paper.<sup>12</sup> Others observe that most patent holders have strong incentives to license their technologies at “reasonable” royalty rates before their patents expire.<sup>13</sup> This view is predicated on the fact that patents depreciate quickly so that any outright or constructive refusal to deal can involve a significant opportunity cost. Rights holders can have private incentives to place their technologies in the public sector as well.<sup>14</sup> Another

---

<sup>9</sup> Daniel G. Swanson & William J. Baumol, *Reasonable and Nondiscriminatory (RAND) Royalties, Standards Selection, and Control of Market Power*, 73 ANTITRUST L. J. 1, 15-21 (2005).

<sup>10</sup> See, e.g., Robert Skitol, *Concerted Buying Power: Its Potential for Addressing the Patent Holdup Problem in Standard-Setting*, 72 ANTITRUST L. J. 727 (2005). See also Lemley & Shapiro, *Patent Holdup*, *supra* note 6 at 2043-44.

<sup>11</sup> Mark A. Lemley, *Ten Things to Do About Patent Holdup of Standards (and One Not to)*, 48 B. C. L. REV. 149, 157-58 (2007); Lemley & Shapiro, *Patent Holdup*, *supra* note 6; Joseph Scott Miller, *Standard Setting, Patents, and Access Lock-In: RAND Licensing and the Theory of the Firm*, 40 Ind. L. Rev. 351, 358 (2007).

<sup>12</sup> See, e.g., R. Polk Wagner, *Information Wants to be Free: Intellectual Property and the Mythologies of Control*, 103 COLUM. L. REV. 995, 1011 (2003).

<sup>13</sup> Richard A. Epstein & Bruce N. Kuhlik, *Is There a Biomedical Anticommons?*, REGULATION, Summer 2004, at 54, 55-56 (arguing that private parties often have strong incentives to avoid harmful outcomes like patent thickets. Private solutions include cross licensing, patent pools, and the strategic denial of property rights). See e.g., Robert P. Merges, *A New Dynamism in the Public Domain*, 71 U. CHI. L. REV. 183, 200 (2004) (“[I]t appears that as intellectual property rights have grown more valuable, firms have made greater investments in PPIs [property-pre-empting investments]”).

<sup>14</sup> Merges, *supra* note 13 at 200.

line of reasoning points to the constraints facing IPR holders even after their technologies are adopted in a standard.<sup>15</sup> The important point here is that even an IPR “monopolist” needs to consider horizontal constraints from complementary IPR holders and vertical constraints in the downstream market since market collapse means no licensing revenues at all.

We posit that the larger issue behind this debate is how prevalent and costly royalty stacking within standard setting is in practice. Answering this is an important prerequisite for determining whether new policy tools are needed to address any problems. Certainly the complements theory behind royalty stacking has stood the test of time.<sup>16</sup> The relevant question is not whether royalty stacking is *possible*, though, but whether it is common enough and costly enough in actuality to warrant policy changes. Because substantive policy changes can be costly to implement and carry the risk of inadvertent negative effects, care needs to be taken to implement only those changes expected to provide benefits that offset the costs.

In this paper, we assess the evidence on royalty stacking within standard setting and consider the policy implications of the proposals aimed at solving the perceived licensing problems. We begin, in Section II, with a review of the law and economics literature that leads to the theory of royalty stacking. This review puts royalty stacking claims into perspective by considering various related theories and evaluating the empirical studies aimed at testing them. In Section III, we discuss existing market mechanisms that can mitigate any IPR licensing problems. Section IV then turns to the various policy proposals summarized above, with an emphasis on costs and benefits. Section V concludes with our overall policy assessment.

We find little evidence of systematic problems of royalty stacking within standard setting that are not already adequately dealt with through existing mechanisms, including cross licensing, patent pools, and repeat play reputation. Of course, the existing methods for addressing licensing problems can involve transaction costs. For example, adding cross licenses where few or none existed before requires time-consuming negotiations and establishing a patent pool requires a great deal of bargaining and compromise among firms with diverse goals and strategies. That said, all of the new policy proposals aimed at curbing royalty stacking would involve transaction costs of their own. Thus the issue, as noted above, is not the existence of costs but rather the relative size of costs. In other words, is there any reason to believe that the new

---

<sup>15</sup> See Klaus M. Schmidt, *Licensing Complementary Patents and Vertical Integration*, 4 (C.E.P.R. Discussion Paper No. 5987, 2006), available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=944169](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=944169).

<sup>16</sup> See generally R.G.D. ALLEN, *MATHEMATICAL ANALYSIS FOR ECONOMISTS*, (St Martin's Press, 1969) (1938); Nicholas Economides & Steven C. Salop, *Competition and Integration Among Complements, and Network Market Structure*, 40 J. INDUS. ECON. 105, 105-23 (1992); Hugo Sonnenschein, *The Dual of Duopoly Is Complementary Monopoly: or, Two of Cournot's Theories Are One*, 76(2) J. POL. ECON. 316, 316-18 (1968).

policies would reduce transaction costs or be more efficient at limiting royalty stacking than the current methods?

One might also worry that a lack of systematic evidence of royalty stacking is more a result of the nature of the complements problem and is thus not definitive. Direct evidence of royalty stacking is, after all, difficult to collect: if a market collapses because of licensing issues, there will be no products or services to evaluate in terms of royalty rates. However, within standard setting contexts we should see signs of the problem building long before any market collapse occurs. Because standard setting generally takes place in the public eye, failures should leave some sort of paper trail. A lack of evidence of this sort therefore sheds light on the commonality of insuperable royalty stacking problems within standard setting. This is not to deny the seriousness of stacking if it were to occur; it is only to say that relatively infrequent occurrences could be effectively dealt with through existing mechanisms without the need for any special policy tailoring risking unintended negative consequences. Here, as always, implementing new policy requires careful cost-benefit analysis to ensure that the cure provided is not worse than the disease.

## II. ROYALTY STACKING: AN OVERVIEW OF THE THEORY AND EVIDENCE

Setting aside Cournot, the modern roots of the royalty stacking proposition can be traced back at least fifteen years.<sup>17</sup> Scotchmer (1991) considered whether and how intellectual property policy should be adapted to reflect the fact that in many fields innovation is sequential and cumulative.<sup>18</sup> Because today's research is launched from the shoulders of yesterday's giants, patent law should be designed to maintain innovation over the long term: "The challenge is to reward early innovators fully for the technological foundations they provide to later innovators, but to reward later innovators adequately for their improvements and new products as well."<sup>19</sup>

Scotchmer focused on patent rules as a means to strike that balance. If patent rights are over-protective, this may result in inefficient monopoly pricing, over-investment in R&D as firms race to be the patent "winner" with

---

<sup>17</sup> Any cutoff, 1991 included, is of course arbitrary. A large body of literature published before 1991 discussed issues related to follow-on research, but many of these frameworks were simple two-period models, where the follow-on research was for a direct improvement to the original invention. See, e.g., Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J. L. & ECON. 265 (1977) (a seminal paper, arguing that patents represent prospecting claims to the follow-on research in a particular area); Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 881 (1990) (observing that in a number of industries "technical advance is cumulative, in the sense that today's advances build on and interact with many other features of existing technology.").

<sup>18</sup> Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law*, 5 J. ECON. PERSP. 29 (1991).

<sup>19</sup> *Id.* at 30.

the big reward, and under-investment in follow-on research since patent infringement is hard to avoid. The first innovators need sufficiently strong rights to create sufficient incentives to induce their pioneering work, but enough profit potential needs to remain for second innovators so that they will invest if it is efficient for them to do so.<sup>20</sup> Thus, coordinating the sequence of innovative steps to maximize innovation requires careful thought to the remuneration of each contributor. It is a short move from here to the horizontal coordination problems implied by royalty stacking.

As a result, this line of thought extends to a number of related theories highlighting the potential for detrimental effects stemming from patenting in industries with cumulative and sequential innovation, including many high technology industries in which cooperative standard setting is important. The remainder of this section summarizes the literature that has built on the implications of cumulative and sequential innovation, leading eventually to the current theory of royalty stacking. For ease of exposition we parse the theories into discrete sub-sections, but as the discussion of each makes obvious, the ideas are so closely related that clear distinctions are not always readily apparent.

#### A. *The Tragedy of the Anti-Commons*

One of the earliest applications of the cumulative and sequential innovation theory was aimed at biotechnology research. While this area tends to have less formal standardization activity than other high-tech sectors (bioinformatics appears to be the exception<sup>21</sup>), writings on biotech have influenced the thinking in other fields.

In an article evaluating the National Institute of Health's (NIH) proposal to patent products resulting from sequencing the human genome, Kiley (1992) argued "[b]ecause every step along the way draws another patent application, the path toward public possession of real benefit is increasingly obscured by dense thickets of intersecting, overlapping, and cross-blocking patents . . . The cumulation of royalty obligations threatens to have [a stunting] effect in biotechnology."<sup>22</sup>

The articles that attached the "anti-commons" label to this "stunting effect" came several years later. Heller and Eisenberg (1998), reasoning along the same lines as Kiley, suggested that the combination of pioneer and follow-on inventors could lead to "too many" patents in biomedical research, ending in a "tragedy of the anti-commons."<sup>23</sup> The tragedy of the commons is a well known

---

<sup>20</sup> Jerry R. Green & Suzanne Scotchmer, *On the Division of Profit in Sequential Innovation*, 26 RAND J. ECON. 20 (1995) (finding patent rights should last longer when the sequential efforts are *not* concentrated in one firm).

<sup>21</sup> See, e.g., Janice M. Mueller, *Patent System Reform: Patent Misuse Through the Capture of Industry Standards*, 17 BERKELEY TECH. L. J. 623, 659-660 (2002).

<sup>22</sup> Kiley, *supra* note 6, at 916, 917.

<sup>23</sup> Heller & Eisenberg, *supra* note 6, at 698.

problem in joint ownership when multiple owners share some property (like a village commons on which sheep will graze) and no one has the right to exclude any one else. The tragedy occurs from overuse—the villagers let their sheep graze too much, so that the field is completely destroyed.<sup>24</sup>[m7] The tragedy of the anti-commons is the mirror image of its better known cousin. When multiple owners share the rights to property but every one of them has the right to exclude all others, the tragedy that can occur results from under-use. Heller (1998) used the analogy of empty store fronts in Moscow post-Communist rule. He noted that the fragmented and bureaucratic nature of retail property ownership in Moscow made it difficult for would-be entrepreneurs to obtain a lease and open shop. So instead, the stores sat empty while shopkeepers set up on the sidewalks using a system of temporary kiosks.

Heller and Eisenberg argue that an anti-commons tragedy could develop in biomedical research via one of two paths. First, the privatization of biomedical research through patenting might create “too many concurrent fragments of intellectual property rights in potential future products.”<sup>25</sup> Alternatively, patent policy might permit “too many upstream patent owners to stack licenses on top of the future discoveries of downstream users.”<sup>26</sup> Even the language these authors use foreshadows the royalty stacking strand of the theory.

Heller and Eisenberg propose three factors as determining whether the proliferation of rights will actually lead to a tragedy of the anti-commons. Transaction costs are at the top of their list. If it is difficult or costly to bundle rights, then it is less likely they will be bundled. This might result, for instance, if the universities involved in biomedical R&D have little capacity to absorb the costs of licensing negotiations. Diversity of interests among rights holders is presented as another obstacle. Certain national labs, such as the NIH, view their public health mission as demanding the widest distribution possible of all research findings. That goal dictates as low a royalty rate as possible. Private firms, on the other hand, are more likely to want to maximize royalty income, or set license fees so as to protect their market share for downstream products. Likewise, firms that pursue end-product development (i.e., vertically integrated firms) and firms that focus primarily on upstream R&D are also likely to be at odds when it comes to coordinating their rights. When rights holders have diverse interests it can be more difficult for them to agree on rights pooling mechanisms—such as patent pools—and thus a tragedy of the anti-commons might be more likely.<sup>27</sup> Finally, Heller and Eisenberg note that cognitive biases

---

<sup>24</sup> Garret Hardin, *The Tragedy of the Commons*, SCIENCE, Dec. 13, 1968, at 1244.

<sup>25</sup> Heller & Eisenberg, *supra* note 6, at 699.

<sup>26</sup> *Id.*

<sup>27</sup> Note that patent pools do not provide a silver bullet for IPR licensing problems. Pool participation is voluntary and firms with different business models can view the benefits of joining quite differently. See Reiko Aoki & Sadao Nagaoka, *The Consortium Standard and Patent Pools* (Hitotsubashi University Research Unit for Statistical Analysis in Social Sciences (Hi-Stat) Working Paper No.32, 2004) (providing a theoretical look at this issue);

can interfere with licensing. They argue that biomedical research firms might tend to overvalue their discoveries, making the cumulative royalty rate for downstream firms too high in the aggregate. Unrealistically optimistic expectations, therefore, might inhibit the bundling of rights and thus increase the odds that a tragedy of the anti-commons develops.

### *B. Patent Thickets*

Shapiro (2001) applies the concern expressed by Kiley over “dense thickets of intersecting, overlapping, and cross-blocking patents” to high technology industries more frequently involved in standard setting.<sup>28</sup> In particular, Shapiro argues that “[t]he need to navigate the patent thicket and holdup is especially pronounced in industries such as telecommunications and computing in which formal standard setting is a core part of bringing new technologies to market.”<sup>29</sup> In establishing this claim, Shapiro cites the dramatic increase in patenting in these two sectors: “The danger of paying royalties to multiple patent owners is hardly a theoretical curiosity in industries such as semiconductors, in which many thousands of patents are issued each year and manufacturers can potentially infringe on hundreds of patents with a single product.”<sup>30</sup>

Referring to “Cournot’s lessons”, Shapiro presents a number of “unattractive consequences” resulting from “multiple patent burdens.”<sup>31</sup> Namely, he argues that a complements problem would not only reduce consumer welfare, it also would lower the profits of patent holders, as compared to a coordinated licensing approach; it can result in market collapse if production is subject to economies of scale; and it “necessarily reduces the return to new product design and development, and thus can easily be a drag on innovation and commercialization of new technologies.”<sup>32</sup>

Shapiro posits that standardization efforts only increase the consequences of the complements problem. For technologies that are easy to invent around “the patented technology contributes little if anything to the final product, and any ‘reasonable’ royalty would be modest at best.”<sup>33</sup> But after the technology is included in a standard or after potential licensees have started manufacturing, the link between value and price can be severed. Here, Shapiro argues, the

---

Anne Layne-Farrar & Josh Lerner, *To Join or Not to Join: Examining Patent Pool Participation and Rent Sharing Rules* (Nov. 2006) (unpublished working paper), <http://ssrn.com/abstract=945189> (providing an empirical look at this issue).

<sup>28</sup> Kiley, *supra* note 6, at 915. More recent papers have applied the patent thicket logic to the field of nanotechnology. See, e.g., Ted Sabety, *Nanotechnology Innovation in the Patent Thicket: Which IP Policies Promote Growth?* 15 ALB. L. J. SCI. & TECH. 477, 479 (2005).

<sup>29</sup> Shapiro, *Navigating the Patent Thicket*, *supra* note 6, at abstract.

<sup>30</sup> *Id.* at 125.

<sup>31</sup> *Id.* at 124.

<sup>32</sup> *Id.*

<sup>33</sup> *Id.* at 125.

patent holder “can credibly seek far greater royalties, very likely backed up with the threat of shutting down the manufacturer. . . .”<sup>34</sup> As a result, standard setting can exacerbate licensing problems by potentially augmenting market power for those firms holding patents disclosed as “essential” for the standard.

### C. Royalty Stacking

In one regard, the royalty stacking theory is the anti-commons problem we began with writ less extreme. Rather than grinding all innovation to a halt, this theory maintains that the many IPRs distributed across numerous rights holders could lead to an extremely costly and inefficient outcome shy of an outright anti-commons tragedy. In another regard, the royalty stacking theory is the individual patent holdup problem, where the patent holder is accused of charging more than the “intrinsic” worth of its patent, writ more extreme. A group of licensors are accused of asking for royalty rates that, in the aggregate at least, are uneconomic for those firms attempting to implement the standard.

There is no bright line between any of the above complements problem theories. One firm with a royalty rate of 60% would probably qualify as patent holdup while 60 firms each seeking 1% would likely qualify as royalty stacking and could lead to a tragedy of the anti-commons if licensing negotiations were ultimately unsuccessful. The area in between these two extremes is gray. Would four firms each asking for 10% fall under holdup or royalty stacking, or even be considered reasonable under certain circumstances? Industry participants have tended to view rights dispersion in the single digits as concentrated and thus not problematic, primarily because transaction costs typically do not prohibit bilateral negotiations when a limited number of firms are involved. For instance, a survey respondent discussing licensing issues in the biomedicine field noted that having to negotiate with “3 to 6” rights holders was “manageable”.<sup>35</sup> In the end, then, the distinction between “fragmented” and “concentrated” is an empirical one dependent on industry and firm details. The arguments summarized above are all theoretical, however, and some rely on restrictive assumptions to achieve their findings; thus these papers cannot be definitive. We therefore turn away from the theory and consider the available quantitative evidence next.

---

<sup>34</sup> *Id.* See Vincenzo Denicolò, Damien Geradin, Anne Layne-Farrar, & A. Jorge Padilla, *Revisiting Injunctive Relief in High-Tech Industries with Non-Practicing Patent Holders*, (Working Paper, Sept. 7, 2007), <http://ssrn.com/abstract=1019611> (assessing how injunctive relief affects licensing negotiations).

<sup>35</sup> John P. Walsh, Ashish Arora & Wesley M. Cohen, *Effects of Research Tool Patents and Licensing on Biomedical Innovation*, in *PATENTS IN THE KNOWLEDGE-BASED ECONOMY* 285, 295 (W.A. Cohen & S.A. Merrill eds., 2003). The president of Ericsson, speaking on patent licensing for mobile telecommunications standards, corroborates this point. “On only a few occasions the IPR rate for WCDMA and HSPA is higher than 4-5%.” Interview with InformaTM with Hakan Eriksson, Ericsson CTO, (February 21, 2007).

*D. Empirical Literature*

The empirical literature testing the validity of the above theoretical claims in the real world is considerably smaller than the theoretical one. More importantly, the empirical evidence developed so far is largely inconclusive. Certainly examples of royalty stacking and related licensing problems can be found, but the question we are concerned with here, how prevalent those problems are, has yet to be answered with clear evidence.

## 1. Evidence from the Semiconductor Industry

The semiconductor industry plays a prominent role in the anti-commons and royalty stacking literature. Here, the evidence of licensing problems is mixed. Hall and Ziedonis (2001) examine the patenting behavior of publicly traded U.S. firms in the industry using both patent data and surveys.<sup>36</sup> In particular, they test whether the pro-patent policy changes in the 1980s (including the creation of the centralized appellate court, the U.S. Court of Appeals for the Federal Circuit) changed patenting behavior among semiconductor firms, and if so, whether any harmful effects are evident as a result. Indeed, the authors do find that large-scale chip manufacturing firms invested “far more aggressively in patents” after the policy changes, so that it appears these firms may be “engaged in patent portfolio races.”<sup>37</sup>

On the other hand, Hall and Ziedonis also find that more firms entered the industry after the policy changes, particularly specialized design shops that outsource all semiconductor manufacturing. Their interviews “suggest that stronger patent rights are especially critical to these [design] firms in attracting venture capital funds and securing proprietary rights in niche product[s] . . . .”<sup>38</sup> This trend highlights that stronger patent rights lowers barriers of entry in the industry and thus increases competition. The authors did not consider royalty rates directly.

In a later paper, Ziedonis (2004) reassesses patent licensing in the semiconductor industry, this time investigating the degree to which the rights were spread among multiple owners (rights fragmentation). Based on patent thicket and anti-commons theory, along with insights from transaction cost theory, Ziedonis predicted that firms would patent more aggressively than expected when the rights to the technology are highly fragmented: “a firm’s bargaining challenge is affected by the level of *dispersion* among rights holders—not just by the number of patents in a ‘thicket’ or the number of owners per se (as modeled by Shapiro, 2001).”<sup>39</sup>

---

<sup>36</sup> Bronwyn H. Hall & Rosemarie Ham Ziedonis, *The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. semiconductor industry, 1979-1995*, 32 RAND J. ECON. 101 (2001).

<sup>37</sup> *Id.* at 104.

<sup>38</sup> *Id.*

<sup>39</sup> Rosemarie Ham Ziedonis, *Don’t Fence Me In: Fragmented Markets for Technology and the Patent Acquisition Strategies of Firms*, 50 MGMT. SCI. 804, 807 (2004).

That is, Ziedonis posited that when the rights are spread across more players, transaction costs are higher and firms will patent more as a defensive measure, to provide bargaining chips in *ex post* licensing negotiations.<sup>40</sup> This effect should be even more pronounced for capital intensive firms, like semiconductor manufacturers, since manufacturing assets are difficult to redeploy. When rights are concentrated, however, bargaining *ex ante* is feasible and strategic patenting should be less important.

As a measure of concentration, Ziedonis constructed a fragmentation index based on patent prior art citations for a group of 72 firms over 21 years. If a firm's patents cite a wide group of rivals' technologies, the rights are considered fragmented. She uses this measure on the premise that "citations reveal some of the technological antecedents of a patent," but also because the "owners of cited patents are 'reasonable proxies for potential licensors.'"<sup>41</sup> She finds that, as predicted, capital-intensive firms patent five times as aggressively in response to average levels of fragmentation compared to firms with average capital intensity, even after she accounts for R&D spending and firm size. However, these firms only patent intensively when confronted with fragmented rights. Ziedonis concludes that her "results suggest the '[patent] portfolio rac[es]' observed in Hall and Ziedonis (2001) [are] not driven by firm-level investments alone, but . . . by the subset of capital-intensive firms drawing upon a fragmented pool of external technologies."<sup>42</sup> Even so, her findings also suggested a private solution emerging in response to the threat of an anti-commons among manufacturers: increased cross-licensing negotiations.

## 2. Evidence from the Software Industry

Noel and Schankerman (2006) analyzed patenting in the software industry, observing that "[l]ike semiconductors, software is a classic example of a complex technology in which cumulative innovation plays a central role."<sup>43</sup> They consider two aspects of patent thicket theory: patent portfolio size, which captures bargaining power, and fragmentation of patent rights, which captures the transaction costs of enforcing patent rights.

Examining large, publicly traded companies, Noel and Schankerman found some evidence of what they term "strategic patenting", but no substantially negative consequences. In particular, they find strong positive R&D spillovers on both patenting and market value for rival firms within a close technology field.<sup>44</sup> They also found that relatively high patenting by a close technology

---

<sup>40</sup> Note that this sort of defensive patenting is typically aimed at cross-licensing, and thus does not imply anything in relation to royalty stacking.

<sup>41</sup> *Id.* at 810.

<sup>42</sup> *Id.* at 805.

<sup>43</sup> Mark A. Schankerman & Michael D. Noel, *Strategic Patenting and Software Innovation* 4 (CEPR Discussion Paper No. 5701, 2006) [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=922111](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=922111).

<sup>44</sup> Market value, as a direct reflection of profit margins, is a relevant variable for the

rival reduces a firm's patenting, counter to the patent portfolio arms race theory. And the authors find a strong positive patent premium (i.e., patenting increases own market value), which they interpret as an indication that patents are important as a means of appropriating innovation rents in software.<sup>45</sup>

On the negative side, Noel and Schankerman also found that higher levels of fragmentation in citation rights, using a measure similar to Ziedonis 2004, increase a firm's patenting and slightly lower its market value, after controlling for a number of factors through regression analysis. This last finding is consistent with the negative portfolio building effects found in Ziedonis (2004). While the Noel and Schankerman evidence is not conclusive for any particular complements problem theory because rights fragmentation can raise transaction costs by requiring negotiations with more parties, regardless of the royalty rate charged, it does point to a negative impact of increased patenting. Thus the market value effect could be driven solely by negotiation costs associated with portfolio building (patent thickets), by royalty stacking, or both.

More important than the precise source of the negative effect, however, is its size. The authors find that a 5% decrease in concentration lowers market value by less than 2%. Moreover, the strategic patenting variables all have small or zero coefficient estimates in the R&D equation, which suggests that royalty stacking is not a problem in software, since if it were present stacking should discourage R&D investment.<sup>46</sup>

### 3. Evidence from the Biomedical Industry

The biomedical industry is the most frequently named industry for patent thicket and royalty stacking problems. Limited evidence exists here as well, but again it does not suggest that complements problems are either widespread or highly costly.

Tullis (2005) relies on arguments about where biotechnology research *should* be as a benchmark for establishing an IPR anti-commons: “[B]iotechnology held the promise for a new generation of revolutionary products and treatments in the 1980s. However, twenty years later, the promise of biotechnology potential remains only a promise. . . Arguably, this shortfall

---

question of royalty stacking and strategic patenting effects. Under the efficient market theory, a firm's stock price will reflect all available information about the firm and its ability to earn profits. As a result, market value reflects the discounted present value of a firm's expected cash flows. Anything expected to disrupt those cash flows, such as increased licensing payments, can be expected to affect market value. See Eugene F. Fama, *Efficient Capital Markets: A Review of Theory and Empirical Work*, 25 J. FIN. 383, 378-88 (1970).

<sup>45</sup> This is consistent with other papers in the literature. See, e.g., Ashish Arora, Marco Ceccagnoli, & Wesley M. Cohen, *R&D and the Patent Premium* (Nat'l Bureau of Econ. Research, Working Paper No. 9431, 2003), available at <http://www.nber.org/papers/w9431>.

<sup>46</sup> We thank Mark Schankerman for pointing this finding out to us.

in biotechnology innovations is the result of a biotechnology anti-commons.”<sup>47</sup>

Determining how the world would have been “but for” some reality is always a daunting task, and any number of contributing factors may be responsible for a perceived unfulfilled promise in biotechnology research. In particular, Adelman (2005) points to “the disparity that exists between the power of biotech methods to generate data, such as genome sequences and probes, and their ability to promote the discovery of new medical procedures and drugs” as the real culprit behind any unfulfilled promises.<sup>48</sup> Pisano (2006) suggests yet another factor: industry structure and organizational issues, such as the lack of integration among costs, rules, technologies, and disciplines in the industry.<sup>49</sup>

Looking at the “should be” question from the other side, Epstein and Kuhlik (2004) consider what we should see if the anti-commons theory were a problem in practice for biomedical research. They argue that “we should expect a decline in the levels of research and development, the value of new patented materials, or the number of patents filed and granted. Yet there is little evidence that any of this has taken place . . . .”<sup>50</sup>

Kitch (2003) concurs, noting that with so many years of history, proponents of the IPR complements problem theories should surely be able to list specific examples of costly market collapse by now. He writes:

. . . it is notable that no one who expresses these concerns [over IPR licensing problems] points to particular patents or particular patent licensing policies that have caused problems. Patents on basic research techniques are licensed widely at license fees which the research community is prepared to pay . . . . The field, meanwhile, continues to advance and the level of activity is high.<sup>51</sup>

Kitch argues that in other industries historical examples of licensing difficulties are available—such as the Wright brothers’ airplane patents at the time of World War I—so a real tragedy of the anti-commons should have some tangible evidence. Merges and Nelson (1990) discuss other prominent historical examples, such as in the radio industry in the mid to late 1910s,

---

<sup>47</sup> Terry K. Tullis, *Application of the Government License Defense to Federally Funded Nanotechnology Research: The Case for a Limited Patent Compulsory Licensing Regime*, 53 UCLA L. REV. 279, 287 (2005).

<sup>48</sup> David Adelman, *A Fallacy of the Commons in Biotech Patent Policy*, 20 BERKELEY TECH. L. J. 985, 1009 (2005).

<sup>49</sup> Gary P. Pisano, *SCIENCE BUSINESS: THE PROMISE, THE REALITY, AND THE FUTURE OF BIOTECH* 156 (Harvard Business School Press, 2006). See generally Gary P. Pisano, *Can Science Be a Business? Lessons from Biotech*, 84 HARV. BUS. REV. 114 (2006).

<sup>50</sup> Epstein & Kuhlik, *supra* note 13, at 55.

<sup>51</sup> Edmund Kitch, *Comment on the Tragedy of the Anticommons in Biomedical Research*, in *PERSPECTIVES ON PROPERTIES OF THE HUMAN GENOME PROJECT ADVANCES*, in 50 *ADVANCES IN GENETICS* 271, 272 (2003).

where patent infringement fights eventually led to the formation of a new company, RCA, to consolidate patent rights at the urging of the U.S. Navy.<sup>52</sup>

Looking at the issue more directly, Walsh, Arora, and Cohen (2003) conducted interviews with biomedical researchers, academics, government officials, and representatives at non-profit organizations.<sup>53</sup> While they report that “research tool patents can impose a range of social costs, and there is some restriction of access”, they also find “little evidence of routine breakdowns in negotiations over rights.”<sup>54</sup> The disconnect between academic theory and industry perception, according to Walsh et al., is that while a great many patents might be filed on the same subject, when more thorough patent clearance reviews for licensing are conducted firms often find that many, if not most, of the patents from the initial search can be eliminated, leaving a relatively small list for license negotiations. More generally, the authors find a number of

“working solutions” that allow . . . research to proceed . . . taking licenses . . . inventing around patents, going off-shore, the development and use of public databases and research tools, court challenges and using technology without a license (i.e., infringement) sometimes under an informal and typically self-proclaimed research exemption.<sup>55</sup>

The authors admit, though, that while these options are privately rational, they may “constitute a social waste.”<sup>56</sup> Taken as a whole, then, we view the evidence in biotech—just as the evidence in semiconductors and software—as suggesting some problems with increased IPRs, but none that rise to the level of an anti-commons or royalty stacking. Instead, voluntary market-based solutions appear capable of handling most of the licensing issues arising from any complements problems.

#### 4. Evidence from Mobile Telephony

Mobile telecom is a relative newcomer to the royalty stacking debate, and as such the empirical studies are more limited here. Lemley and Shapiro (2007) present two case studies. They begin with 3G cellular technology, which involves several standards and a large number of patents disclosed by their owners as potentially “essential” for each one. For instance, for the European version of 3G, WCDMA, nearly 7,000 essential patents were declared to the

---

<sup>52</sup> Merges & Nelson, *supra* note 17 at 893.

<sup>53</sup> Walsh et al. *supra* note 35 at 295. *But see* Paul David, *The Economic Logic of ‘Open Science’ and the Balance between Private Property Rights and the Public Domain in Scientific Data and Information: A Primer*, (Stanford Inst. for Econ. Pol’y Res. Working Paper No. 02-30, 2003) 13-14, *available at* <http://siepr.stanford.edu/Papers/pdf/02-30.pdf>. (questioning the findings of Walsh et. al. because no details regarding their questionnaire and interview technique were provided).

<sup>54</sup> Walsh et al., *supra* note 35 at 289.

<sup>55</sup> *Id.* at 331.

<sup>56</sup> *Id.* at 332.

European Telecommunications Standards Institute (ETSI) as of early 2004. This number is inflated, however, since it includes patents from all jurisdictions (U.S., Europe, Asia), many of which are counterparts filed for global coverage of the same rights. Nonetheless, even if we were to limit the patents to just those issued by the U.S. patent office, we would still have a sizeable number. And those patents are held by a fairly large number of firms—over forty firms in all are represented. Lemley and Shapiro argue that a royalty stacking problem exists in 3G based on these patent and firm counts. They do not present any data on royalty rates, however, observing that “[i]t is not clear what the total cost of these stacked royalties is. We have seen estimates as high as 30% of the total price of each phone, but those were based on summing royalty demands before any cross-licensing began.”<sup>57</sup>

At least on the surface WCDMA appears to be a candidate for royalty stacking because innovation is cumulative and patenting is prolific. That said, this standard fails to meet the third criterion emerging from the literature reviewed above—that IPRs are fragmented. Roughly 75% of the many patents are held by just four firms. More importantly, the anecdotal evidence on cumulative royalty rates is difficult to interpret in the absence of a meaningful benchmark. Assume that the cumulative royalty rate were 30% for some manufacturers: if those firms had no patents of their own to offer in cross license it is not clear that 30% would be unreasonable. If a manufacturer were implementing other’s innovations and adding little of its own contribution aside from molding the plastic and inserting the chips, a 30% cumulative royalty might be *too low*. The point here is that numbers in isolation mean little; they need to be put into context.<sup>58</sup>

Considering evidence on the expansion of WCDMA, it appears that the technology is being licensed and has achieved remarkable penetration today.<sup>59</sup> For example, 3G technology reached 40 percent penetration in Japan and South Korea last year, within 5 years of initial commercialization efforts.<sup>60</sup> If

---

<sup>57</sup> Lemley & Shapiro, *Patent Holdup*, *supra* note 6, at 2026.

<sup>58</sup> For firms with patents to cross license, the aggregate rates appear to be considerably lower. For instance, Ericsson recently noted that “[o]n only a few occasions the IPR rate for WCDMA and HSPA is higher than 4-5%.” Interview by Paul Lambert of InformaTM with Hakan Eriksson, CTO, Ericsson (February 21, 2007).

<sup>59</sup> SIGNALS RESEARCH GROUP, TAKIN’ IT TO THE STREETS: AN UPDATE ON WCDMA MARKET DEVELOPMENTS AROUND THE WORLD, 3 (2006), <http://www.signalsresearch.com> (last visited Feb. 21, 2008).

<sup>60</sup> NTT DoCoMo launched FOMA, the world’s first 3G mobile service based on W-CDMA in 2001. See NTT DoCoMo: Company Overview, <http://www.nttdocomo.com/about/company/index.html> (viewed Dec 18, 2001). See also Timo Poropudas, *3G Penetration Grows to 40% in Japan and South Korea*, MOBILE MONDAY, Apr. 20, 2006, [http://www3.mobilemonday.net/mm/story.php?story\\_id=4750](http://www3.mobilemonday.net/mm/story.php?story_id=4750) (last visited Feb. 21, 2008). All major European operators started commercial operation of GSM networks in 1992. See UMTS - 3G History and Future Milestones, <http://www.umtsworld.com/umts/history.htm> (viewed Dec 18, 2001).

current trends persist, the penetration rate is expected to surpass 60 percent in Europe by 2010.<sup>61</sup> In contrast, the 2G technology GSM, for which there were no allegations of royalty stacking, took 7 years to reach similar penetration rates in Europe.<sup>62</sup> If royalty stacking or other IPR complements problems were significant for 3G, it is doubtful the standard would have achieved these relatively rapid growth rates.

For their second case study, Lemley and Shapiro (2007) consider Wi-Fi. Here too the authors draw a line from extensive patenting and a large number of rights holders to a royalty stacking problem. They also note that one patent lawsuit related to the standard ended with a 6% royalty rate award. The implication from this statistic is that if every patent holder charged 6%, there would be a royalty stacking problem given the large number of patent holders.

We find this case study too speculative to establish evidence of a significant complements problem in Wi-Fi. First, technological contributions vary substantially across patents,<sup>63</sup> so knowing that one patent was awarded 6% by the courts tells us nothing about the remaining IPRs. This one patent might have been the most pivotal for the standard—and indeed studies of patent lawsuits suggest that the more valuable patents tend to be the ones litigated.<sup>64</sup> Second, court awarded royalty rates often include an element of punishment to ensure that future infringement is deterred.<sup>65</sup> Thus, this one rate may be an outlier in comparison to non-litigated rates since it could capture both estimated patent value *and* deterrence. Furthermore, Lemley and Shapiro note

---

<sup>61</sup> See STEFAN HENG, DEUTSCHE BANK, UMTS BROADBAND MOBILE TECHNOLOGY ROLLED OUT: CONFOUNDING MANY EXPECTATIONS 2-10 (2006), [http://www.dbresearch.com/PROD/DBR\\_INTERNET\\_EN-PROD/PROD0000000000199922.pdf](http://www.dbresearch.com/PROD/DBR_INTERNET_EN-PROD/PROD0000000000199922.pdf).

<sup>62</sup> GSM was providing service to over 200 million people in 1999 and over 400 million in 2000, amounting to over 50% penetration by 2000. AUDREY SELIAN, INT'L TELECOMM. UNION, *3G MOBILE LICENSING POLICY: FROM GSM TO IMT-2000 - A COMPARATIVE ANALYSIS*, <http://www.itu.int/osg/spu/ni/3G/casestudies/GSM-FINAL.pdf>.

<sup>63</sup> This is well established in the literature. See, e.g., Ariel Pakes, *Patents as Options: Some Estimates of the Value of Holding European Patent Stocks*, 54 *ECONOMETRICA* 755 (1986); Frederick M. Scherer & Dietmar Harhoff, *Technology Policy for a World of Skew-Distributed Outcomes*, 29 *RES. POL'Y.* 559 (2000); F.M. SCHERER, S. HERZSTEIN, JR., A. DREYFOOS, W. WHITNEY, O. BACHMANN, C. PESEK, C. SCOTT, T. KELLY, & J. GALVIN, *PATENTS AND THE CORPORATION: A REPORT ON INDUSTRIAL TECHNOLOGY UNDER CHANGING PUBLIC POLICY*. (2nd ed. 1959).

<sup>64</sup> Jean O.Lanjouw & Mark A. Schankerman, *Stylized Facts of Patent Litigation: Value, Scope and Ownership* 24-25 (NBER Working Paper No. W6297, 1997), available at <http://ssrn.com/abstract=139666>.

<sup>65</sup> Technically speaking, only truly “punitive” damages have this element, although it is widely thought that punitive concerns affect actual royalty determinations. See Roger D. Blair & Thomas F. Cotter, *Rethinking Patent Damages* (February 23, 2001) (unpublished working paper, available at <http://ssrn.com/abstract=261357>).

that several of the Wi-Fi standard participants had already formed a patent pool, meaning that firms voluntarily sought a solution to the number of licenses needed and that a substantial portion of the standard's IP is available in a single-price bundle.<sup>66</sup>

None of the industries studied thus far in the empirical literature provide evidence of significant and widespread licensing problems unresolved by market mechanisms. Unfortunately, the ideal data for analyzing royalty stacking predictions—licensing contracts and negotiated royalty rates before and after the policy changes that increased patenting in high technology fields—is simply not publicly available. The dearth of data may be the reason for the lack of persuasive evidence in any industry to settle how pervasive and costly royalty stacking might be.<sup>67</sup> However, despite the availability of direct evidence, indirect evidence is available. We do not see signs of significant royalty stacking problems in WiFi or other industries in such indirect indicators as commercial market growth or R&D expenditures.<sup>68</sup> The lack of

---

<sup>66</sup> See Layne-Farrar & Lerner, *supra* note 27 at 27 for more on the Wi-Fi patent pool.

<sup>67</sup> As one more piece of contributory evidence consider the litigation records. In our review of U.S. court cases, we were able to find only seven cases that involved allegations of unfair, unreasonable, or excessive patent license prices within a standard setting context. This figure aggregates cases by parties, since a particular dispute between firms frequently results in multiple lawsuits, across multiple jurisdictions. For example, Rambus has been involved in numerous district court cases plus an FTC investigation, but all of these pertain to Rambus's behavior regarding the same patents that were adopted by one SSO. Given the decades of SSO activity (many SSOs date back to the 1960s and 1970s) and the hundreds of thousands of firms participating in these SSOs, finding only seven disputes were significant enough to lead to a lawsuit filing is a remarkable testament to existing mechanisms for dispute resolution. A list of the seven aggregated cases is available from the authors.

<sup>68</sup> MuniWireless estimates the U.S. wireless market will experience year-to-year growth rates of around 33 percent from 2007 through 2010. In 2007 the market spend was \$329 million on products and services for US municipal wireless networks, 35% year over year growth from 2006. Non-PC WiFi enabled devices are growing in number and more counties are getting involved in large-scale WiFi projects. See summary of MUNIWIRELESS,, 2007 STATE OF THE MARKET REPORT, <http://www.muniwireless.com/article/articleview/6553/1/23> (last visited Dec 18, 2007). As further indication of healthy growth, Broadcom, one of the top wi-fi chip vendors, came out with a new product line in 2007 implementing the latest 802.11n draft specifications, and is actively continuing to roll out new Wi-Fi technology. See Press Release, Broadcom, Broadcom's Dual-Band 802.11n Solutions Deliver the First Real Wi-Fi Multimedia Experience (Jan 7, 2008), <http://www.broadcom.com/press/release.php?id=1092219>. Many 2007 smart phone models, such as Apple's iPhone, T-Mobile's Shadow, AT&T's Tilt, and Nokia's E61i and E65 phones are wi-fi enabled, building on a trend over the last few years. The rush to patent wi-fi related technology has also shown no signs of abating: Microsoft and Apple have recently filed for patents that will bring different wireless sharing capabilities to both the iPod/iPhone and the Zune. See Jacqui Cheng, *Patents from Microsoft and Apple reveal future plans for WiFi on Zune, iPod*, ARSTECHNICA, July 12, 2007, <http://www.arstechnica.com/news.ars/post/20070712-patents-from-microsoft-and-apple->

indirect evidence therefore suggests another alternative: that self-interest is enough to push firms toward market mechanisms for solving any complements problem on their own, without intervention. We discuss these methods next.

### III. MARKET MECHANISMS FOR OVERCOMING ROYALTY STACKING

Voluntary arrangements can circumvent IPR licensing problems without the need for regulatory interference or policy changes. A number of such arrangements are seen in practice, and their presence suggests that royalty stacking fears are likely overblown. As Heller and Eisenberg point out in their theoretical article on the possibility of an anti-commons tragedy in the biomedical industry, such tragedies are not a foregone conclusion, even in the face of “too many” patents. They observe that “[w]hen the background legal rules threaten to waste resources, people often rearrange rights sensibly and create order through private arrangements.”<sup>69</sup> We agree, and see such “rearrangements” as the real reason hard evidence on royalty stacking has yet to be presented.

#### A. IPRs as a Means for Increasing Public Knowledge

One mitigating factor is the use of IPRs to increase public knowledge. The theoretical literature has tended to assume that if IPRs are granted, they will be pursued and enforced to their full extent. A few authors, however, suggest that to the contrary, strong IPRs may in fact enable more information to reach the “commons” than is typically recognized and thus actually increase access.

Among this latter camp is Wagner (2003), which disputes the suggestion that intellectual property rights are detrimental to “the continued flourishing of a public domain of ideas and information.”<sup>70</sup> Two key points that the anti-commons theory overlooks, according to Wagner, are (a) the difference between physical property and intellectual property and (b) the difference between the short-term and the long-term. Wagner argues that the theory of the anti-commons, as well as other related criticisms of IPRs, understate the significance of the intangible nature of information and thus neglect the contribution that even perfectly controlled intellectual creations make to the public domain.<sup>71</sup> For example, a patent on a particular form of hybrid corn may prevent other agribusinesses from exactly copying the corn, but businesses can learn the value of hybrid corn to the market by observing the patented product’s success and this can spur them to try other hybridization processes. Thus, Wagner finds “even perfectly controlled works nonetheless transfer

---

reveal-bigger-wifi-plans-for-zune-ipod.html.

<sup>69</sup> Heller & Eisenberg, *supra* note 6, at 700 (highlighting institutions that have emerged within communities of IP owners who deal with one another on a recurring basis, such as copyright collectives in the music industry and patent pools in various manufacturing industries).

<sup>70</sup> Wagner, *supra* note 12, at 995.

<sup>71</sup> *Id.*

significant information into the public domain, it turns out that over the long term, additional control is likely to stimulate additional works—and thus grow the public domain, even assuming no access to the protected work itself.”<sup>72</sup>

On a more pragmatic note, Wagner observes that granting a right and actually enforcing it are two distinct things: “a great deal of intellectual property infringement occurs every day.”<sup>73</sup> Thus, even well intentioned IPR policies provide less restriction in reality than on paper.

This point is reinforced when we consider the cost of enforcing rights. Firms, especially smaller ones with limited resources, may rationally decide not to enforce certain patent claims because the cost-benefit tradeoff does not justify enforcement. Moreover, a threat of enforcement is only credible if its maker is seen as having the resources to pursue a full-blown trial. Thus, only the most valuable patents tend to be prosecuted.<sup>74</sup>

Merges (2004) develops a theory that expands the reasons for not always enforcing rights: IPRs allow firms to contribute technologies to the public domain, all as a part of their private profit-oriented strategy.<sup>75</sup> For example, in the mid 1990s Merck created a public database of gene sequences, the Merck Gene Index, collaboratively with Washington University. The effort was estimated to have cost the firm several million dollars, but in return Merck was able to preempt the threat that patents on gene sequences would stall its for-profit research projects.<sup>76</sup> In the computer industry, IBM’s investments in open source software and its patent contributions to the public domain serve an analogous purpose: with increased contributions to open source IBM gains a relatively low-cost software platform that enhances its hardware, service, and complementary proprietary software sales.<sup>77</sup> This strategy also “undermine[s] one key opponent—Microsoft—whose market power interferes with IBM’s goals.”<sup>78</sup>

As Merges explains, property preempting investments (PPIs) of this type are important for two reasons: “(1) they indicate that strong rights lead to investments in the public domain; and (2) they suggest a private ordering response to the phenomenon of the ‘anticommons.’”<sup>79</sup> He posits that market activity such as PPIs suggests that “[p]rivate action may offset some of the effects of an anticommons, making it less necessary to act on the normative

---

<sup>72</sup> *Id.* at 1000.

<sup>73</sup> *Id.* at 1010.

<sup>74</sup> See Jean O. Lanjouw & Mark Schankerman, *Characteristics of Patent Litigation: A Window of Competition*, 32(1) RAND J. ECON. 129, 147 (2000).

<sup>75</sup> Merges, *supra* note 13, at 184.

<sup>76</sup> *Id.* p. 188.

<sup>77</sup> *Id.* p. 192. See also Martin Campbell-Kelly & Daniel Garcia-Swartz, *Pragmatism not Ideology: IBM’s Love Affair with Open Source Software*, (Oct. 2007) (working paper, on file with authors).

<sup>78</sup> Merges, *supra* note 13, at 193.

<sup>79</sup> *Id.* at 186.

agenda of anticommons theory, an agenda that involves restricting property rights and carries obvious risks and costs.”<sup>80</sup> Moreover, Merges observes that this mechanism can be self-calibrating: “It appears that as intellectual property rights have grown more valuable, firms have made greater investments in PPIs.”<sup>81</sup>

### *B. Incentives to License*

The profit motive can also be a reason *to* license IPRs. Epstein and Kuhlik (2004) point to patent holders’ self interest as a deterrent to patent holdout and the tragedy of anti-commons.<sup>82</sup> Because patent holders, at least non-vertically integrated ones who rely on licensing as a significant source of income, profit from actively licensing their patents, these authors argue that:

Refusing to deal is a loss of opportunity. In addition, the patent is always a wasting asset; not only is it limited in time, but even during the period of its unquestioned validity its holder faces the possibility that new patents, old patents that have expired, and new techniques that come into the public domain will erode its dominance. Those who do not deal will not prosper. . . .<sup>83</sup>

In addition to incentives to negotiate licenses, IPR holders also have incentives to license at reasonable rates. Standard setting is a dynamic process, frequently with multiple iterations for any given standard issuing over time. Patent holdup, on the other hand, is a short term strategy. Firms gaining a reputation for this kind of tactic will face stronger opposition on the next version of the standard because rival firms are reluctant to accept their technological suggestions or have invented around their technology to preempt any future holdups. In fact, the examples of patent holdup put forth in the literature are few in number and indeed often involve firms that have no long-term plan in the industry.<sup>84</sup> In terms of royalty stacking for individually reasonable royalty rates, market collapse due to excessive aggregate royalties is certainly not an outcome that is in anyone’s best interests, especially non-practicing patent holders with no downstream revenues.<sup>85</sup>

Incentives to license can also be strong for vertically integrated firms. While

---

<sup>80</sup> *Id.* at 190.

<sup>81</sup> *Id.* at 200.

<sup>82</sup> Epstein & Kuhlik, *supra* note 13, at 55.

<sup>83</sup> *Id.*

<sup>84</sup> See, e.g., Bronwyn H. Hall & Rosemary Ham Ziedonis, *An Empirical Analysis of Patent Litigation in the Semiconductor Industry* (Working Paper), [http://elsa.berkeley.edu/~bhhall/papers/HallZiedonis07\\_PatentLitigation\\_AEA.pdf](http://elsa.berkeley.edu/~bhhall/papers/HallZiedonis07_PatentLitigation_AEA.pdf) (prepared for the 2007 American Economic Association annual meeting, Chicago, IL, January 4-7, 2007).

<sup>85</sup> Schmidt, *supra* note 15.

these firms may have business models centered on downstream earnings as opposed to upstream royalty fees, when complementary IPRs are involved, cross-licensing is an important cooperative strategy. As noted earlier, formal standards generally involve a number of complementary patents, each covering a distinct component of the standard. Firms wishing to implement the standard must obtain licenses for all of the necessary components, to which they do not already have rights. Thus, the standard increases its chances of success in the marketplace when all participating manufacturing firms holding relevant patents agree to cross-license one another. Along these lines, Shapiro writes that “the impressive rate of innovation in the semiconductor industry in the presence of a web of such cross licenses [sic] offers direct empirical support for the view that these cross licenses [sic] promote rather than stifle innovation.”<sup>86</sup>

Cross-licensing does, of course, involve costs. Bilateral negotiations can be time consuming and sometimes difficult. In particular, it is often hard to estimate the value of patents, but some sort of value calculation may be necessary in order to arrive at balancing payments that offset the two parties’ portfolios.<sup>87</sup> Of more concern, cross-licensing can be a means to restrict competition. This can occur when a small number of manufacturing firms holding patents on key technologies cross-license one another but refuse to license newcomers, or license outsiders only at exorbitant rates.<sup>88</sup> This strategy is less viable when key patents are held by non-vertically integrated firms. For instance, when R&D focused firms hold essential patents, they have incentives to broadly license as a means of revenue generation.<sup>89</sup>

Despite the various potential pitfalls, cross-licensing appears to be growing in industries with significant standardization activity and can therefore be viewed as a voluntary means for navigating patent thickets, albeit one that

---

<sup>86</sup> Shapiro, *supra* note 6 at 130.

<sup>87</sup> Deepak Somaya & David J. Teece, *Combining Inventions in Multi-invention Products: Organizational Choices, Patents, and Public Policy* (Haas School of Business CCC Working Paper No. 99-4, 2000), available at <http://ssrn.com/abstract=259889>.

<sup>88</sup> For examples of this in practice, see ADAM JAFFE & JOSH LERNER, *INNOVATION AND ITS DISCONTENTS: HOW OUR BROKEN PATENT SYSTEM IS ENDANGERING INNOVATION AND PROGRESS, AND WHAT TO DO ABOUT IT* 60-64 (Princeton University Press, 2004). See also Rudi Bekkers, Bart Verspagen & Jan Smits, *Intellectual property rights and standardization: the case of GSM*, 26 TELECOM. POL’Y. 171, 179-80 (2002).

<sup>89</sup> Schmidt, *supra* note 15, at 12-15. See also Rudi Bekkers & Joel West, *The Effect of Strategic Patenting on Cumulative Innovation in UMTS Standardization* (DIME Working Papers on Intellectual Property Rights, Working Paper No. 9, 2006), available at [www.dime-eu.org/files/active/1/IPR-WORKING-PAPER-9\\_BekkersWest.pdf](http://www.dime-eu.org/files/active/1/IPR-WORKING-PAPER-9_BekkersWest.pdf). Shapiro (2001) describes Intel’s cross licensing practices, which the Federal Trade Commission attacked in 1998, in discussing the potential for competitive misuse. When Intergraph threatened to file an infringement suit against Intel, Intel responded by revoking all of its IP from Intergraph, even though that IP was covered under a non-disputed cross license. See Shapiro, *Navigating the Patent Thicket*, *supra* note 6, at 131.

requires some antitrust oversight.

### C. *The Benefits of IPR Pooling*

Patent pooling is another means of solving the complements problem, as pools mimic Cournot's original solution of aggregating the complements under one entity's control.<sup>90</sup> Under a pool, owners of patents deemed essential to a standard opt to form a joint license in order to bundle at least some subset of the essential IPRs into a single package.<sup>91</sup> The participating firms agree on an aggregate royalty rate for the package and on a method of dividing the royalty earnings amongst themselves.<sup>92</sup> As part of the arrangement, members often get a discounted cross license to one another's patents.

Voluntary mechanisms of this sort enable manufacturers to obtain the necessary complementary rights to implement a standard at a lower cost than purely bilateral licensing. This lower cost occurs because cooperation among pool members tends to maintain low royalty rates and because the aggregation of rights itself lowers the transaction costs of negotiating licenses.<sup>93</sup>

As standardization efforts have become more important, more patent pools have emerged from those efforts. The turning point was 1995, when the Department of Justice and the Federal Trade Commission issued new guidelines for intellectual property that recognized the pro-competitive aspects of patent pools.<sup>94</sup> Testing the perceived antitrust regime shift, MPEG (Motion Picture Expert Group) sought business letter clearance from the DOJ to create a patent pool based on its standard for digital video.<sup>95</sup> MPEG received clearance, which opened doors to a number of other standards wishing to form pools, including other MPEG standards as well as electronic, computing, and telecommunications standards.<sup>96</sup>

The fact that firms often seek DOJ approval before forming a patent pool highlights the concern that pools may create antitrust issues. Due to this concern, competition authorities regularly oversee patent pool arrangements.<sup>97</sup>

---

<sup>90</sup> See Merges, *supra* note 5; Shapiro, *Navigating the Patent Thicket*, *supra* note 6, at 127.

<sup>91</sup> Participation in a patent pool is entirely voluntary and rarely, if ever, includes all eligible firms. For this reason, pools typically only bundle a subset of the needed patents. Layne-Farrar & Lerner, *supra* note 27, at 2.

<sup>92</sup> *Id.* at 12.

<sup>93</sup> Julie Gallagher, *Patent Pool Aims to Spur RFID Adoption*, SUPERMARKET NEWS, Aug. 22, 2005, at 91.

<sup>94</sup> U.S. DEP'T JUSTICE & FED. TRADE COMM'N, ANTITRUST GUIDELINES FOR THE LICENSING OF INTELLECTUAL PROPERTY 27-29 (1995).

<sup>95</sup> Fax from Joel L. Klien, Acting Assistant Att'y Gen., to Gerrard R. Beeney, Esq., Att'y for MPEG LA, L.L.C., Member Orgs. and Affiliates, (June 26, 1997) (on file with the Dep't of Justice), available at <http://www.usdoj.gov/atr/public/busreview/215742.pdf>.

<sup>96</sup> Layne-Farrar & Lerner, *supra* note 27, at 3.

<sup>97</sup> See generally Josh Lerner & Jean Tirole, *Efficient Patent Pools*, 94 AM. ECON. REV.

Perhaps the most serious issue in patent pool formation is their potential use as vehicles for cartels. Because pools are combinations of otherwise competitors who meet to set aggregate licensing prices, pools can be employed to fix prices and tie IPRs, such as when non-essential or substitute patents are combined into a single take-it-or-leave-it bundle. By and large, however, pools are viewed as pro-competitive by competition agencies today. And the DOJ has even softened its stance on the inclusion of substitutes, recognizing that under the right circumstances substitute patents pose no competitive threat.<sup>98</sup>

#### IV. POLICY PROPOSALS

The discussion in the preceding section suggests that market-driven mechanisms can effectively deal with potential complements problems in at least some instances and thus can help firms steer clear of royalty stacking and anti-commons tragedies. As noted, however, many of the market responses entail costs or raise antitrust concerns. The relevant question, then, for policy proposals aimed at complements problems is whether any of the proposals offer lower costs and less competitive risk than the existing mechanisms. If not, or if the proposals carry other risks, then they should not be pursued since their expected benefits will fall short of their expected costs. In this section, we review, with an eye towards their costs and benefits, the various policy proposals targeting royalty stacking and patent holdup.

##### A. Patent Reform

As a solution to holdup and other licensing problems, Shapiro (2006) calls for policy changes to improve patent quality, reducing the odds that weak patents are granted by the patent office. He argues that poor quality patents are the worst offenders in terms of holdout, holdup, and other IPR licensing inefficiencies. Thus, weeding out such patents at the U.S. patent office would go a long way to solving IPR licensing issues later on within (as well as outside of) standard setting.

This is the least controversial of the proposals. It is widely recognized, and not just among the academics pushing for radical change in the patent system, that IPR reform is long overdue. To name just a few of the more recent examples, see the article by Nancy Gallini, the working paper by Mark Lemley, Doug Lichtman, and Bhaven Sampat, and the book by Adam Jaffe and Josh Lerner—all of which review, assess, and expound on the need for intelligent patent reform.<sup>99</sup>

---

691(2004); Richard J. Gilbert, *Antitrust for Patent Pools: A Century of Policy Evolution*, 2004 STAN. TECH. L. REV. 1 (2004); Roger B. Andewelt, *Analysis of Patent Pools Under the Antitrust Laws*, 53 ANTITRUST L. J. 611 (1984).

<sup>98</sup> U.S. DEP'T JUSTICE & FED. TRADE COMM'N, ANTITRUST ENFORCEMENT AND INTELLECTUAL PROPERTY RIGHTS: PROMOTING INNOVATION AND COMPETITION 74-78 (2007).

<sup>99</sup> Nancy T. Gallini, *The Economics of Patents: Lessons from Recent U.S. Patent Reform*,

We agree that patent reform would be helpful, on a number of fronts. As this article was being written, Congress appeared to agree as well. While some of the specific elements remain controversial, the Patent Reform Act of 2007 had been passed by the House of Representatives and was being considered by the Senate.<sup>100</sup> The Act calls for a number of reforms, including, among other things:

Damages calculations: The latest version would allow judges discretion in the method for calculating reasonable royalties. Judges could follow an apportionment analysis (based on the incremental value contributed by the patented technology), entire market analysis (where the full end product is used as the basis for royalties), or other criteria, such as the *Georgia Pacific* 15 factors. This provision would address concerns over patents on minor components obtaining large royalties by virtue of the calculations being based on the overall product sales.<sup>101</sup> Of course, from a purely mathematical standpoint, an ad valorem royalty rate can be adjusted up or down as the base decreases or increases, rendering such concerns mute. For instance, a 2.5% rate on 100% of the product sales would be equivalent to a 5% rate on a 50% increment of the overall product sales.

Willful infringement: The standard for establishing treble damages would be raised from its current negligence standard.<sup>102</sup> Patent owners would have to present clear and convincing evidence that the infringer unreasonably disregarded prior notices, copied the patented technology outright, or behaved in some other blatant fashion. Accused infringers would be allowed to present a “good faith belief” defense. The theory behind this proposal is that with a reduced threat of treble damages,

---

16 J. ECON. PERSP. 131 (2002); Jaffe & Lerner, *supra* note 88; Mark Lemley, Doug Lichtman & Bhaven Sampat, *What to do about Bad Patents?*, 28 REGULATION 10 (2005). See also Ian Ayres & Gideon Parchomovsky, *Tradable Patent Rights: A New Approach to Innovation* (U. Pa. Inst. for L. & Econ. Res., Working Paper No. 07-23, 2007), available at <http://ssrn.com/abstract=1020276>.

<sup>100</sup> Two versions of the Act are currently under consideration. Patent Reform Act of 2007, H.R. 1908, 110th Cong. (2007); Patent Reform Act of 2007, S.1145, 110th Cong. (2007).

<sup>101</sup> For example, the judgment against Microsoft in *Alcatel-Lucent v. Microsoft* was originally set at \$1.52 billion. Microsoft's Windows Media Player was deemed to infringe Alcatel-Lucent's software, but damages were calculated with respect to the average cost of the entire PC (a five fold difference in price versus the software alone). A new trial over damages has since been ordered. See Maya Eckstein, *2007 Patent Reform Act Could Bring Needed Changes*, DAILY RECORD (Rochester, NY), May 30, 2007.

<sup>102</sup> Since the two bills were first introduced, the Supreme Court decided *In re Seagate Technology, LLC*, which establishes a new higher standard for establishing willful infringement and allowing for enhanced damages. *In re Seagate Tech., LLC*, 497 F.3d 1360 (Fed. Cir. 2007).

holdup should be less likely.

Post grant review: Patents could be challenged more easily by third parties. During the so-called “first window of review,” up to 12 months after issuance, the patent would *not* be presumed valid, as it is today. Increased scrutiny should lead to higher quality issued patents. This proposal thus targets perceived low patent quality, the problem at the root of many other patent concerns.

Lawsuit venue: The proper venue for patent infringement cases would be restricted so that the venue matched more closely the circumstances of the case. This would reduce “venue shopping,” where patent holders file suit in jurisdictions more likely to be favorable to their case.<sup>103</sup>

On a purely pragmatic note, we point out that regardless of whether this particular Act is ultimately passed (and in what form), well thought out patent reform would be complementary to existing voluntary market mechanisms, including property preempting investments, reputation effects, cross licensing, and patent pools. Solid patent reforms are probably among the best ways to alleviate the risk of royalty stacking and other licensing issues, as stemming the patent flood and eliminating weak patents would reduce overall patent counts and limit those remaining to valuable contributions. As with all reforms, patent reform should be done with care to avoid unintended consequences.<sup>104</sup>

### B. Ex Ante Licensing

Procedures to capture ex ante competition as a means of curbing ex post royalties are another popular proposal area. Under this prescription, some regulatory agency would encourage (or perhaps even mandate) SSOs to institute ex ante licensing disclosure rules. The Department of Justice and the Federal Trade Commission have, in fact, taken this position. In their joint report released in April 2007, *Antitrust Enforcement and Intellectual Property Rights: Promoting Innovation and Competition*, the agencies devote a lengthy sub-section to ex ante licensing as a means to mitigate holdup. They write that “well-defined licensing commitments could be introduced into the standard-setting process through ex ante unilateral announcements of licensing terms by IP holders . . . .”<sup>105</sup>

The attraction of instituting an ex ante licensing policy within SSOs is that competition over technologies during a standard’s development can be harnessed as an efficient delimiter on ex post pricing. After a standard is defined and a particular technology has been chosen for incorporation into a standard (or more likely, into a given component of that standard), that

---

<sup>103</sup> See Julie Creswell, *So Small a Town, So Many Patent Suits*, N.Y. TIMES, Sept. 24, 2006, at Sec. 3 (describing the Federal Court for the Eastern District of Texas, which has a reputation for large awards in patent infringement trials).

<sup>104</sup> In particular, the process should not be swayed by special interest groups.

<sup>105</sup> U.S. DEP’T JUSTICE, *supra* note 98, at 49.

competition naturally ceases—although the standard itself may compete with outside alternatives. With ex ante licensing, patented technologies that faced stiff competition during the development phase of a standard would have lower royalties, reflecting the many close substitutes available.<sup>106</sup> Patented technologies with little or no viable substitutes during the development phase would be able to legitimately charge higher royalty rates, reflecting the higher value contributed to the resulting standard.

This proposal is the only complements problem suggestion to have been put into practice. The DOJ has granted business letter clearance to two SSOs—VITA (VMEbus International Trade Association) and IEEE (Institute of Electrical and Electronics Engineers)—to implement ex ante licensing disclosure policies.<sup>107</sup> VITA's new policy mandates that each member must, among other things, declare the maximum royalty rate that it intends to seek for all of its patent claims that may become essential to implement the standard in question. VITA member companies must also disclose their most restrictive non-royalty terms. Once made, the disclosed rate is held as the maximum allowable, although VITA permits patent holders to submit later declarations with less restrictive licensing terms (that is, lower royalties). Thus, the disclosure is meant to place a binding price cap on royalty rates. IEEE's new policy is similar, although here members are simply encouraged (not required) to disclose their sought-after licensing terms when they disclose their IPRs to the SSO.

While the appeal of ex ante licensing disclosure is obvious for the reasons listed above, it does have several down sides. First, introducing licensing and commercial interests into standard development procedures would undoubtedly slow the process down.<sup>108</sup> Firms could no longer rely on engineers and technical experts as their sole (or at least primary) representatives within an SSO, but would instead need to include on the team lawyers and business strategists. With more issues to resolve—technical specifications plus license pricing—and a more diverse group of people having to reach agreement—engineers, lawyers, and managers—standard setting would surely take longer. This would be especially problematic in fast-paced industries, such as those in

---

<sup>106</sup> In fact, depending on the level of competition, royalties could even approach zero, covering only the recurring costs of maintaining a licensing program. See Anne Layne-Farrar, A. Jorge Padilla & Richard Schmalensee, *Pricing Patent for Licensing in Standard Setting Organizations: Marking Sense of FRAND Commitments* (Working Paper, 2006), <http://ssrn.com/abstract=937930>.

<sup>107</sup> See Thomas O. Barnett, Response to VMEbus International Trade Association (VITA)'s Request for Business Review Letter, Dep't Justice Antitrust Division (2006), available at <http://www.usdoj.gov/atr/public/busreview/219380.htm>; Thomas O. Barnett, Response to Institute of Electrical and Electronics Engineers, Inc.'s Request for Business Review Letter, Dep't Justice Antitrust Division (2007), available at <http://www.usdoj.gov/atr/public/busreview/222978.htm>.

<sup>108</sup> This was pointed out by the experts who testified before the DOJ and FTC for their preparation for the joint IP report as well. See U.S. DEP'T JUSTICE, *supra* note 98, at 49.

the ICT sector.

Second, requiring ex ante disclosure as VITA does disregards the complex, dynamic nature of standard setting. It may well be the case that SSO members do not know the precise value a proposed standard will confer before it actually reaches the marketplace. Consumer preferences, the availability of competing products and services, even the full functionality of the standard may emerge only upon commercialization. As a result, information problems of this sort can only be resolved ex post. In this case, any ex ante licensing declarations will be based on imperfect information, resulting in what the economics literature refers to as an “incomplete” contract.<sup>109</sup> Voluntary disclosure regimes like IEEE’s, however, allow for these informational issues; firms can disclose licensing terms ex ante if and when it makes sense for them to do so.

Mandatory disclosure also ignores the fact that some patent holders do not intend to seek any royalties but cannot commit to a zero rate. In particular, firms that hold patents for defensive purposes typically do not actively enforce their IPRs, but instead use them as bargaining chips in negotiations with other firms. The value of such chips would be eviscerated if the firms had to declare ex ante that no royalties would be sought. On the other hand, naming a positive royalty rate would falsely signal higher aggregate licensing costs. Depending on the number of firms following a defensive strategy within a given SSO, mandatory term disclosure could even signal a patent thicket when none in fact existed.

SSO auctions are aimed at the same goal as unilateral disclosure rules, but would provide more formal structure.<sup>110</sup> During the development phase of a new standard, the SSO would hold an auction over all IPR submitted for consideration in a particular standard component. IPR holders would submit both technical specifications and specific offers to license the technology downstream. SSO members would then bid/vote on the technology-price packages. The technology winning the auction would then be incorporated into the final standard and the technology holder would be held to the terms proposed in the auction. Auctions are, however, more of theoretical construct than a working policy suggestion. Certainly implementing such auctions would be exceedingly difficult given the multi-component nature of the products and services competing for adoption by a standard. Moreover, firm diversity within an SSO can lead to bias in an auction process. In fact, SSO auctions present such significant design issues that the outcomes could not be guaranteed to be efficient.<sup>111</sup> This likely explains why the SSOs experimenting with ex ante

---

<sup>109</sup> See, e.g., Oliver Hart & John Moore, *Foundations of Incomplete Contracts*, 66 REV. ECON.STUD. 115, 115 (1999).

<sup>110</sup> See Swanson and Baumol, *supra* note 9.

<sup>111</sup> See Damien Geradin, Anne Layne-Farrar, & A. Jorge Padilla, *The Ex Ante Auction Model for the Control of Market Power in Standard Setting Organizations* 31 (Working Paper, 9 April 2007), <http://ssrn.com/abstract=979393>.

licensing term disclosure have chosen unilateral statement policies as opposed to actual auctions.

For all of the reasons explained above, we maintain that SSOs choosing to pursue ex ante disclosure should institute a voluntary, and not mandatory, policy. With optional disclosure encouraged rather than dictated, an SSO can provide increased commercial information to its members without unduly restricting their business strategies in relation to their IPRs and without pushing members into inefficient contracts based on less than complete information. In fact, at least one member firm has left VITA in the wake of its new mandatory IPR term disclosure policy.<sup>112</sup> While maximizing SSO participation may or may not be good policy, increased participation in cooperative standardization efforts should increase ex ante competition over the technologies to be included. As such, more participation could lead to better quality standards with lower IPR royalty rates. Policies that reduce incentives to participate in SSOs therefore likely represent a cost to the standardization process.

### *C. Joint Negotiations Among Licensees*

Taking ex ante licensing disclosure even further, another proposal advises antitrust authorities to take a relaxed view of joint negotiations of licensing terms within an SSO before a standard is adopted. For example, Ohana, Hansen, and Shah (2003) argue that licensing term disclosure coupled with joint negotiations within an SSO offers “the best prospect of achieving a competitive outcome to a standard setting initiation without excessive cost, delay or reduction in innovation.”<sup>113</sup>

The U.S. antitrust agencies have evidently taken up this suggestion. In their joint report of spring 2007, the DOJ and FTC noted that joint ex ante negotiations “may lead to price competition” and enable members to make “tradeoffs between price and technical merit.”<sup>114</sup> They therefore pledge to evaluate such negotiations under a rule of reason, rather than as per se illegal.

The agencies did acknowledge the dangers of group negotiations, however. For example, they observed that such negotiations would not be reasonable in cases where the technology being considered faced no viable alternatives. In this case, ex ante negotiation among potential licensees would “simply eliminate competition among the potential licensees for the patented technology.”<sup>115</sup> In our view, the agencies did not place enough weight on this concern. The majority of SSOs have far more IPR licensees than IPR holders, so the risk of concerted buyer power to hold royalties *below* their competitive

---

<sup>112</sup> Motorola left VITA shortly after the new policy was implemented.

<sup>113</sup> Ohana et al., *supra* note 8, at 644. See also Lemley and Shapiro, *Patent Holdup*, *supra* note 6, at 2043-44; Skitol, *supra* note 10, at 729.

<sup>114</sup> U.S. DEP’T JUSTICE, *supra* note 98, at 52-53.

<sup>115</sup> *Id.* at 53.

level strikes us as a very real concern.<sup>116</sup> Moreover, the same incomplete information problems discussed above for ex ante disclosures would be at play under a joint negotiation plan as well. For these reasons, we do not believe that moving to joint ex ante licensing negotiations is a wise policy change.

#### *D. Limiting Injunctive Relief*

The last of the proposals targeted at licensing issues within standard setting would involve a shift in court policy. According to some authors, when a firm joins an SSO and commits to an IPR policy it forfeits its traditional right to seek injunctive relief for patent infringement.<sup>117</sup> The idea here is that making SSO commitments is akin to agreeing to an actual license, where only the details have yet to be determined. Under this view, SSO-member patent holders do not have access to injunctions since infringement cannot occur when a contract is in place. In addition, others have recommended that injunctive relief be denied to certain other classes of patent holders. Shapiro (2006) falls into this camp, proposing that “non-competing patent holders” be denied injunctive relief as a means of reducing patent holdup.<sup>118</sup> Stripped of the threat of plant shutdown, patent holders are in a weakened negotiating position, less able to practice holdup, and more likely to agree to lower royalties.

Most authors recognize the value of injunctive relief in general. For example, Lemley and Shapiro (2007) “consider the presumptive right to injunctive relief to be an important part of the patent law.”<sup>119</sup> We agree. While we do not advocate automatic injunctive relief, in our opinion the categorical limitations proposed shift bargaining power too far in favor of licensees. Consider first denying injunctive relief to all IPRs holders within an SSO that have made a FRAND commitment. The language of most SSO commitments is quite vague and cannot be read to suggest abdication of injunctive relief. For instance, IEEE’s policy requires “a statement that a license for a compliant implementation of the standard will be made available to an unrestricted number of applicants on a worldwide basis without compensation or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination.”<sup>120</sup>

---

<sup>116</sup> For the same reason Lemley (2006) argues against SSOs setting cumulative royalty rate caps: “antitrust law would be right to worry that SSOs that see their members as mostly buyers rather than sellers of IP rights will set a total royalty rate that is artificially low.” Lemley, *supra* note 11, at 161.

<sup>117</sup> Miller, *supra* note 11, at 358; Lemley & Shapiro, *Patent Holdup*, *supra* note 6; Lemley, *supra* note 11, at 157-58.

<sup>118</sup> Carl Shapiro, *Injunctions, Hold-Up, and Patent Royalties*, (Competition Policy Center, Working Paper CPC06-062, 2006), available at <http://repositories.cdlib.org/iber/cpc/CPC06-062>.

<sup>119</sup> Lemley & Shapiro, *Patent Holdup*, *supra* note 6, at 2035.

<sup>120</sup> IEEE, IEEE-SA STANDARDS BOARD BYLAWS (Apr. 2007),

Second, the proposal to limit injunctive relief among non-competing patent holders is based on restrictive assumptions that are likely to hold only in very narrow circumstances.<sup>121</sup> For instance, Lemley & Shapiro's analysis presumed that patent holders are always over-compensated, despite a lack of evidence supporting such a presumption.<sup>122</sup> Instead, patent holders might be under-compensated as a result of situations where many competing patent holders vie for inclusion in a standard. In this case, further weakening their bargaining power could harm innovation. Moreover, IPR holders have little or no leverage in negotiations because, given the commercial consequences of participating in standard setting, holders have a limited ability to walk away from an SSO. The risk, then, is indeed under-compensation. In the post *eBay* world, courts should apply the established four-factor equity test to determine whether an injunction is granted; they are no longer automatic dispensed.<sup>123</sup> This four-factor test substantially limits a patent holder's ability to use the threat of an injunction to achieve holdup.

Refusing injunctions for "non-practicing" patent holders is equally troublesome. Denicoló, Layne-Farrar, and Padilla (2007) demonstrate that non-practicing patent holders can have little incentive to use injunctions to shut down licensees.<sup>124</sup> This follows because R&D focused firms earn no downstream revenues but instead rely on licensing income. If a licensee has no sales, it pays no royalties to any patent holder. Non-practicing patent holders can therefore have strong incentives to reach agreement with licensees in order to ensure a revenue stream. In contrast, if the IPRs in question are held by a rival manufacturing company, then depending on the level of product differentiation this patent holder can have stronger incentives to shut down a competing licensee. Without the option of making an equity argument in court for injunctive relief, patent holders within standard setting could face the threat of concerted buyer power reducing their IPR returns to sub-competitive levels.

## V. POLICY CONCLUSIONS

We began this paper with a proposition: if royalty stacking and other complements problems in IPR licensing were not prevalent, then the case for instituting policy reform to fix those problems would be weak. The fact that such problems are more than theoretical possibilities and do occur in the real world is not enough. They must occur with some regularity before implementing policy changes aimed at them should be considered. Once that threshold is reached, the second question is whether the proposed policy changes would actually improve matters over the status quo.

---

<http://standards.ieee.org/guides/bylaws/sect6-7.html>.

<sup>121</sup> Denicoló, Layne-Farrar, & Padilla, *supra* note 34.

<sup>122</sup> Vincenzo Denicoló, *Do Patents Over-Compensate Innovators?* 22(52) *Econ. Pol'y* 679, 2007.

<sup>123</sup> *eBay Inc., v. MercExchange, L.L.C.*, 547 U. S. 388; 126 S. Ct. 1837 (2006).

<sup>124</sup> Denicoló, Layne-Farrar, & Padilla, *supra* note 34.

We hold this view not because we are adverse to change or especially supportive of the status quo, but because we recognize that all courses of action involve costs. This is true of the market mechanism firms are currently relying on to work around complements problems, and it is true of the proposed policy shifts suggested as replacements or supplements for those voluntary market mechanisms. The decision of whether to implement the new proposals thus requires a comparison of the costs and benefits.

Our analysis of the proposals has therefore focused on the known costs and potential unintended consequences that might result if these proposals were implemented. When the proposals did not offer the promise of reducing overall costs as compared to the status quo, or if the proposal ran the risk of creating harmful incentives as a side effect, then we concluded that the policy is not warranted. Based on this approach, we find that patent reform likely would be helpful, particularly since reform would get closer to the root of the licensing problems as opposed to treating its symptoms. Likewise, ex ante licensing disclosure might be helpful, as long as the SSO reached consensus on its need and implemented the policy as a voluntary program and not a mandatory one. Joint negotiations, on the other hand, could too easily tip toward under-compensation for IPR holders, which would affect long term incentives to innovate and incentives to participate in cooperative standard setting in a detrimental way. Nor do categorical limitations on injunctive relief represent attractive reforms. For example, eliminating injunctive relief for non-practicing patent holders would tip the scales too far toward licensees but do nothing for reducing holdup potential among vertically integrated firms offering licenses to rival manufacturers.

In the end, considering both the scant evidence that royalty stacking and other complements issues are widespread and recurring problems, along with the availability of several countervailing market responses, we find that were society to implement several of these policy recommendations it would risk setting a course for Scylla in the absence of any evidence of danger from Charybdis.<sup>125</sup>

---

<sup>125</sup> For those of you who have forgotten your classical education, these are the two sea monsters from Homer's *Odyssey*. Scylla and Charybdis dwelled on opposite sides of a narrow strait so that sailors attempting to avoid Charybdis would fall prey to Scylla and vice versa. The monsters symbolize a state where one is between two dangers and moving away from one will cause you to be in danger of the other.